Living Health Economic Evaluation (with R)

Dr. Robert Smith & Dr. Paul Schneider

NICE Technical Forum
17th May 2023

DARK PEAK ANALYTICS

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Who are we anyway?

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Dr. Paul Schneider

Dr. Robert Smith

Dr. Sarah Bates

ShangShang Gu

Wael Mohammed

MS Excel vs R (python / others)

				Comments	Link to Slide
1	Familiarity Barriers to entry	●●●●	●	Coding in R is hard	Teaching
2	Capabilities	●●	●●●● ●	… but much more powerful	Comparison
3	Computational Speed	●	●●●●	… and faster	Benchmark
4	Development & Iteration speed	●●	●●●●	… and easier to develop at scale	Living HTA
5	Transparency	●●	●●●● ●	… and more robust (int. & ext. review)	Packages; Data/model
6	Engagement & Visualisation	●●●	●●●●	… and looks better	Shiny UI

An entirely personal, and very biased set of estimates!

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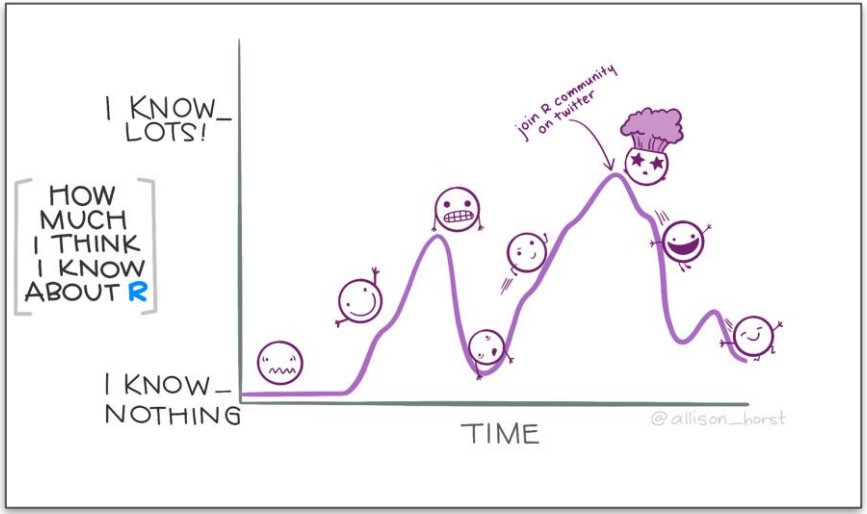
(*Not so*) Short Course



https://r4he.netlify.app/about-the-authors.html

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If statistics programs/languages were cars ...

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Computational speed

	R	Excel
Average Time (seconds) required for 10,000 simulations	31.8	872.7

27x faster

Hollman, C., Paulden, M., Pechlivanoglou, P. and McCabe, C., 2017. A comparison of four software programs for implementing decision analytic cost-effectiveness models. *Pharmacoeconomics*, *35*(8), pp.817-830.

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Living HTA

PharmacoEconomics (2023) 41:227–237
https://doi.org/10.1007/s40273-022-01229-4

LEADING ARTICLE

Living Health Technology Assessment: Issues, Challenges and Opportunities

Praveen Thokala[1] · Tushar Srivastava[1,2] · Robert Smith[1,3] · Shijie Ren[1] · Melanie D. Whittington[4] · Jamie Elvidge[5] · Ruth Wong[1] · Lesley Uttley[1]

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Abstract
Health technology assessments (HTAs) are typically performed as one-off evaluations and can potentially become out-of-date due to the availability of new data, new comparators, or other factors. Recently, living approaches have been applied to systematic reviews and network meta-analyses to enable evidence syntheses to be updated more easily. In this paper, we provide a definition for 'Living HTA' where such a living approach could be applied to the entire HTA process. Living HTA could involve performing regular or scheduled updates using a traditional manual approach, or indeed in a semi-automated manner leveraging recent technological innovations that automate parts of the HTA process. The practical implementation of living HTA using both approaches (i.e., manual approach and using semi-automation) is described along with the likely issues and challenges with planning and implementing a living HTA process. The time, resources and additional considerations outlined may prohibit living HTA from becoming the norm for every evaluation; however, scenarios where living HTA would be particularly beneficial are discussed.

Key Points for Decision Makers

Health technology assessments (HTAs) are typically performed as one-off evaluations and can quickly become out-of-date.

Living HTA approaches can ensure that the HTAs are up-to-date, and potentially living HTAs could be updated manually or (semi-)automatically using innovative software platforms.

However, living HTA involves substantial time, planning and resource commitments, and as such should only be used in situations where it is important to ensure the HTA is up-to-date.

1 Introduction

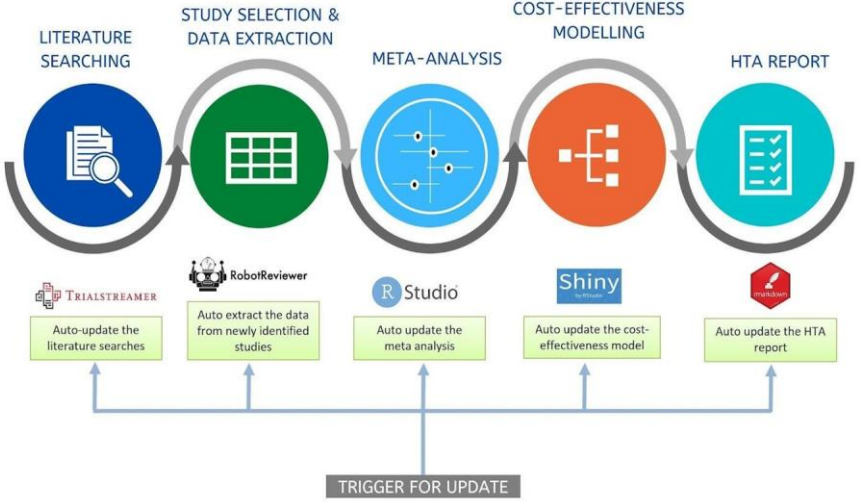
Health technology assessment (HTA) agencies perform evaluation of clinical and cost-effectiveness evidence of new interventions to decide whether they should be reimbursed. These are typically performed as one-off evaluations and can potentially become out-of-date due to various reasons (e.g., availability of new data, new comparators, new methods, etc.). While some HTA agencies perform updates of HTAs periodically if certain criteria are met, these updates are typically a few years apart and the results of updates may already be out-of-date by the time of the publication.

There is growing recognition of the need for the HTA process to respond to an evolving evidence base, particularly in reimbursement decisions with high uncertainty. A recent paper on 'Life-cycle HTA' suggests that HTA must explore the value of health technologies from inception through maturity, and proposes a model for integrating changes arising from new evidence to feed into adoption, no adoption and disinvestment decisions [1]. However, as far as we know, there is no literature on the practicalities of performing a responsive, dynamic HTA (which we call 'Living HTA').

While examples of living systematic reviews and living meta-analyses are already well established, living HTA is not yet fully defined or understood. In this paper, we outline the ways in which the different parts of HTA can become out-of-date, and provide a definition for living HTA and the situations in which it could be useful. While there are similarities between living HTA and the updates that HTA groups make, we outline how the living HTA process could potentially be operationalised from the outset, provide

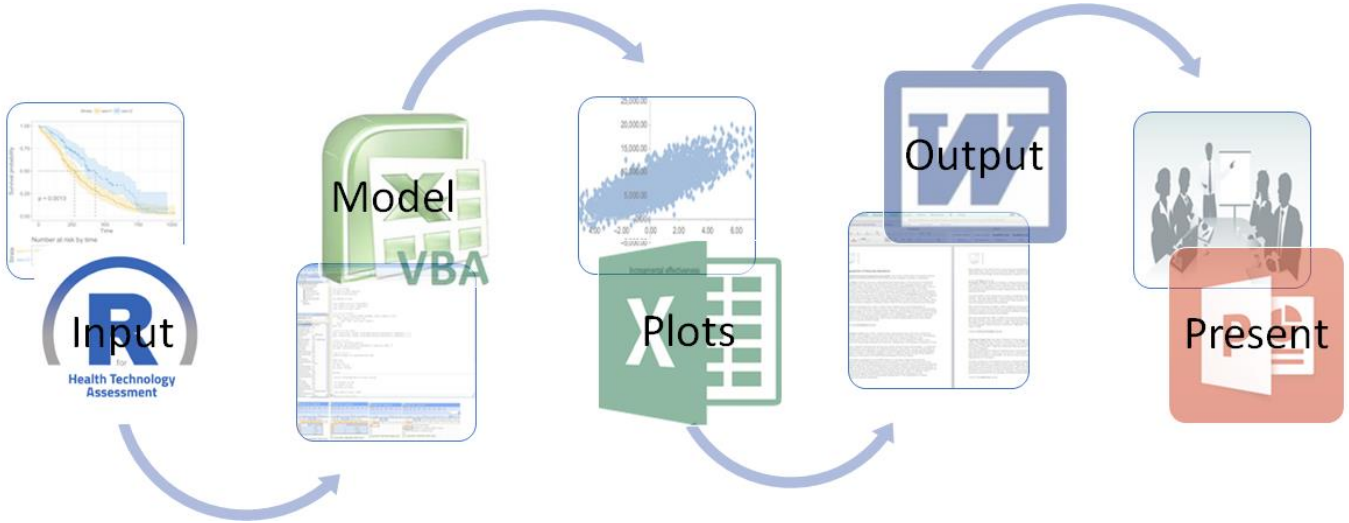
Extended author information available on the last page of the article

Figure 3: Potential example living HTA using (semi-)automation

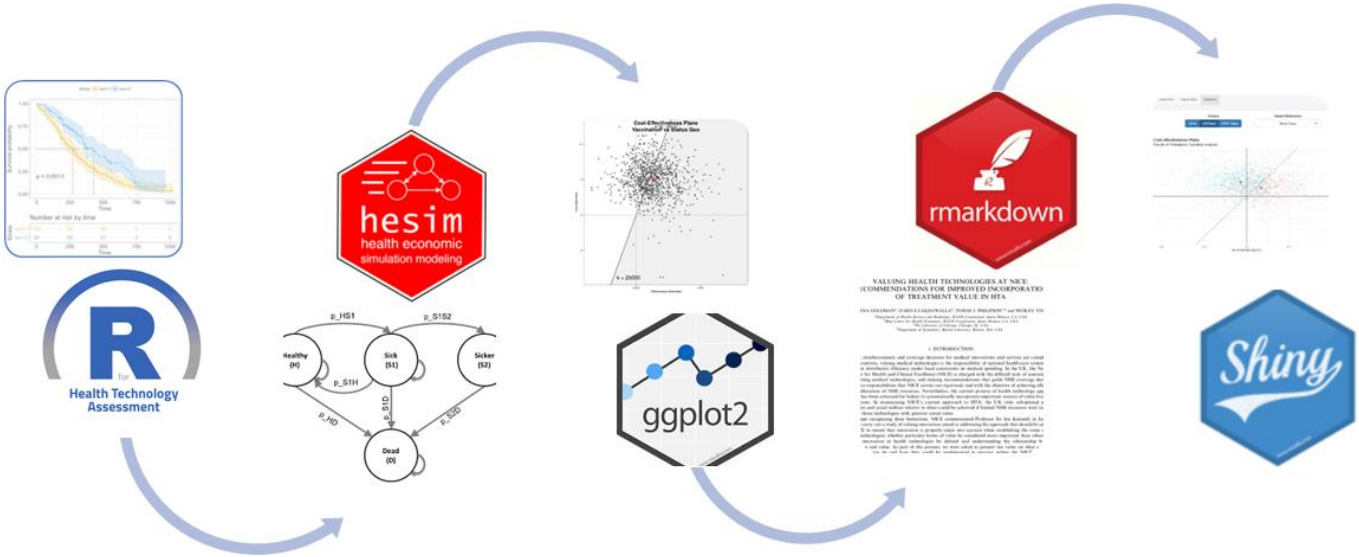


Thokala, P., Srivastava, T., **Smith, R.**, Ren, S., Whittington, M.D., Elvidge, J., Wong, R., Uttley, L. (2023). Living Health Technology Assessment – Issues, Challenges and Opportunities. *Pharmacoeconomics*.

Current process

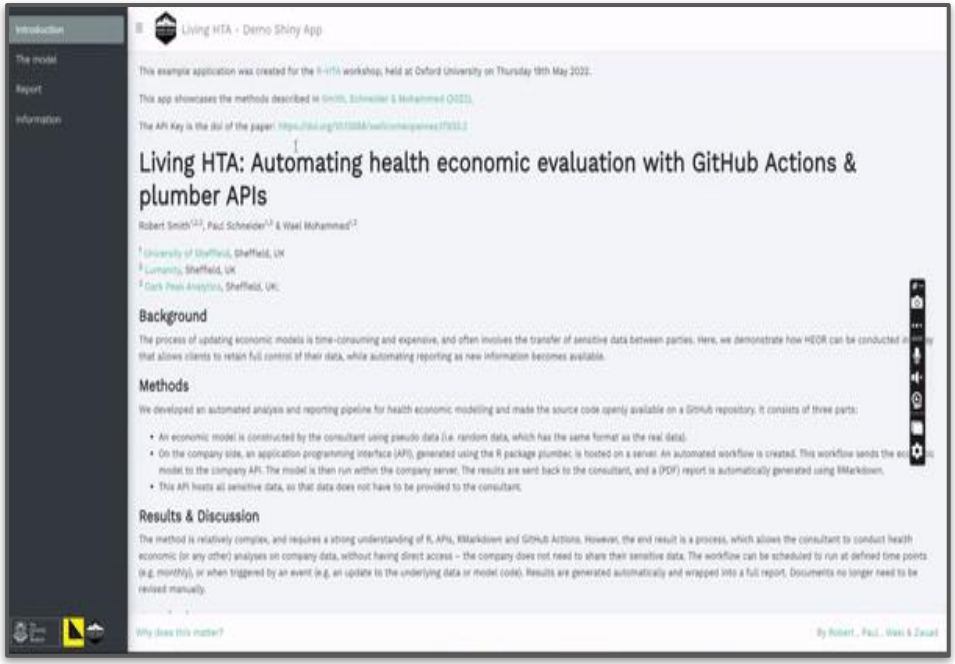


Future process



Living HTA

Smith RA, Schneider PP and **Mohammed W**. Living HTA: Automating Health Economic Evaluation with R. *Wellcome Open Res* 2022, **7**:194 (https://doi.org/10.12688/wellcomeopenres.17933.2)



https://darkpeakanalytics.shinyapps.io/living_HTA_demo/

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Living HTA

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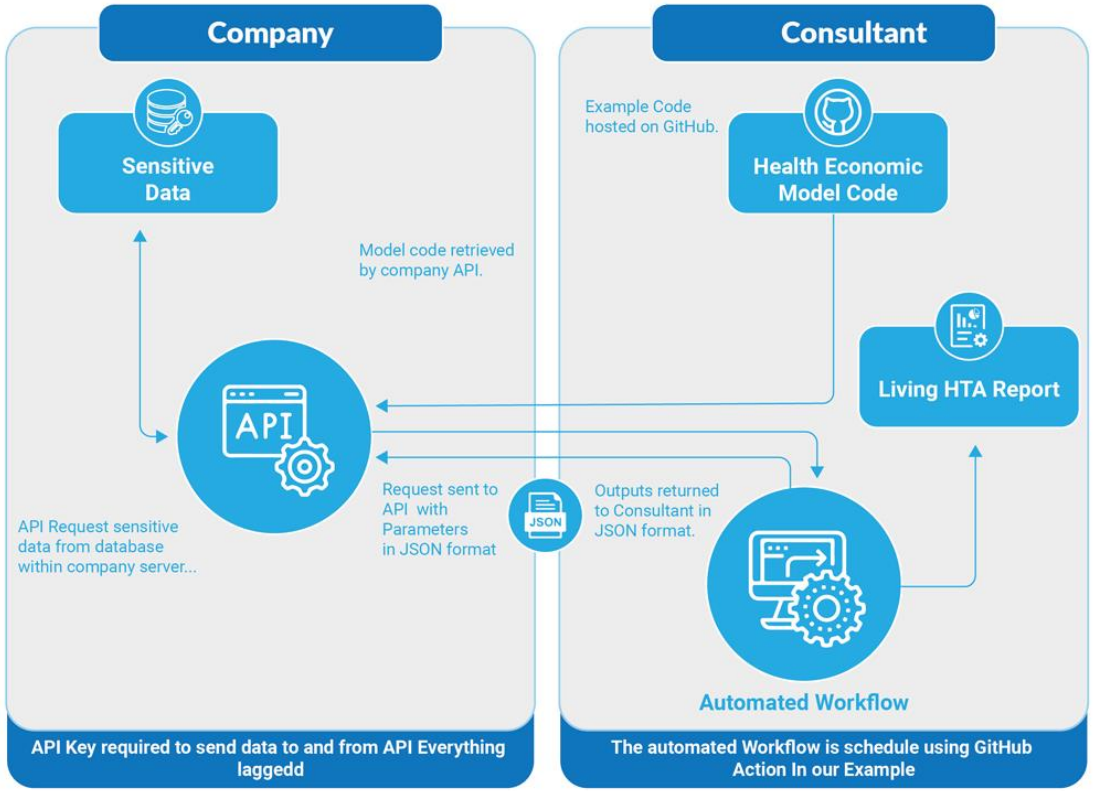

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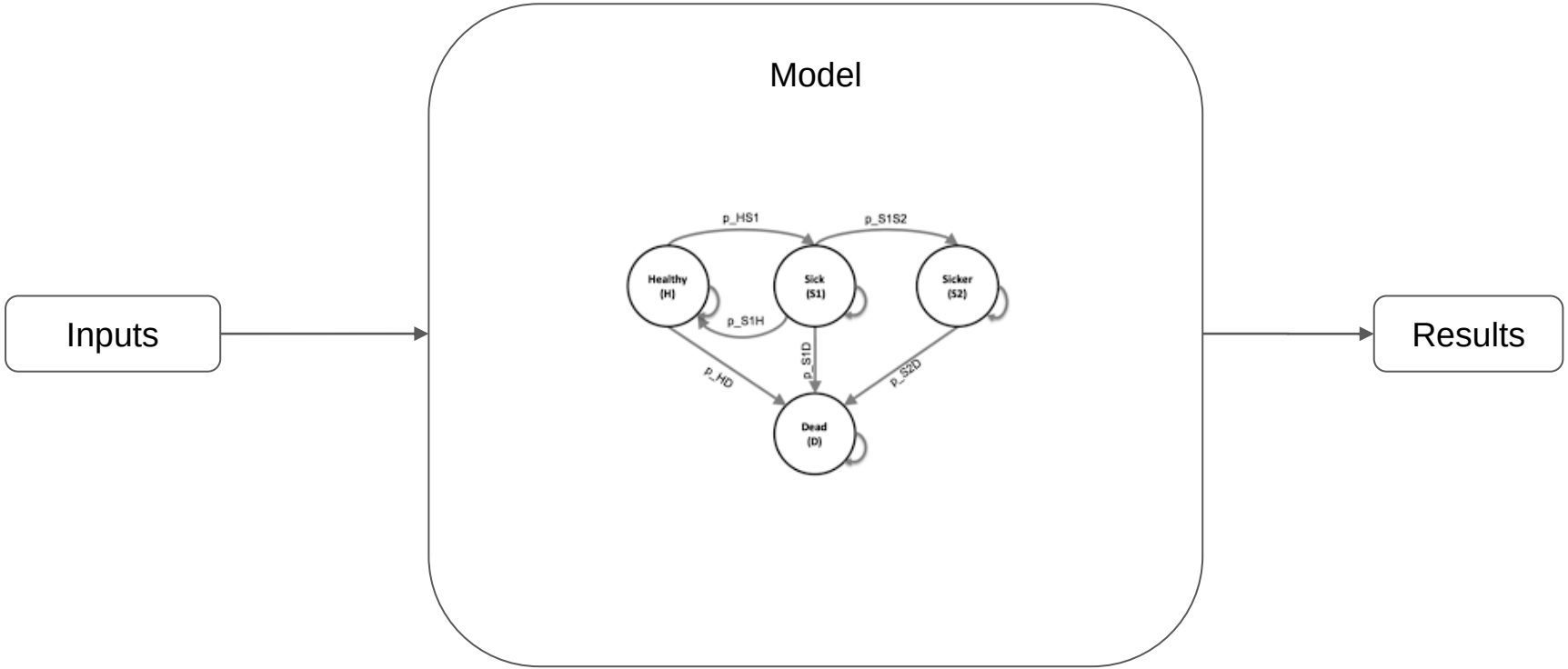
Building a model in R



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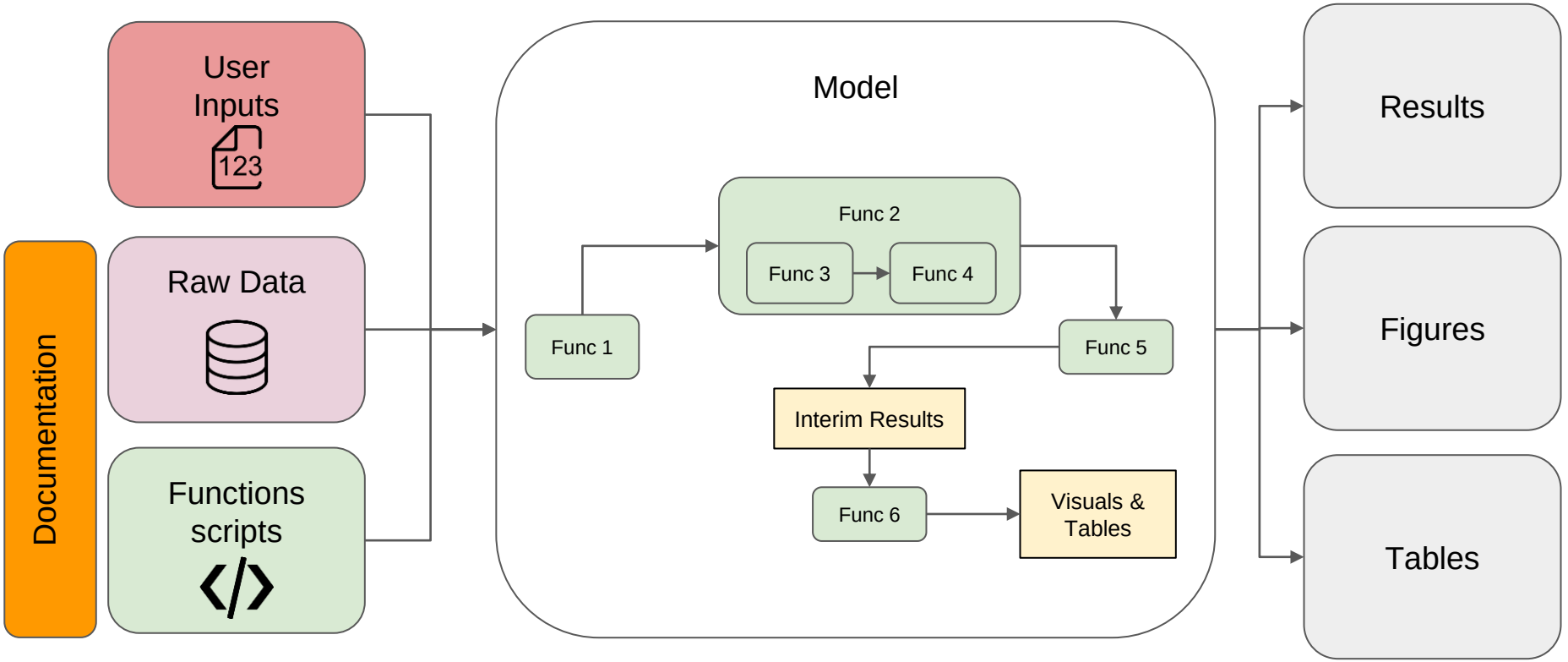

Building a model in R

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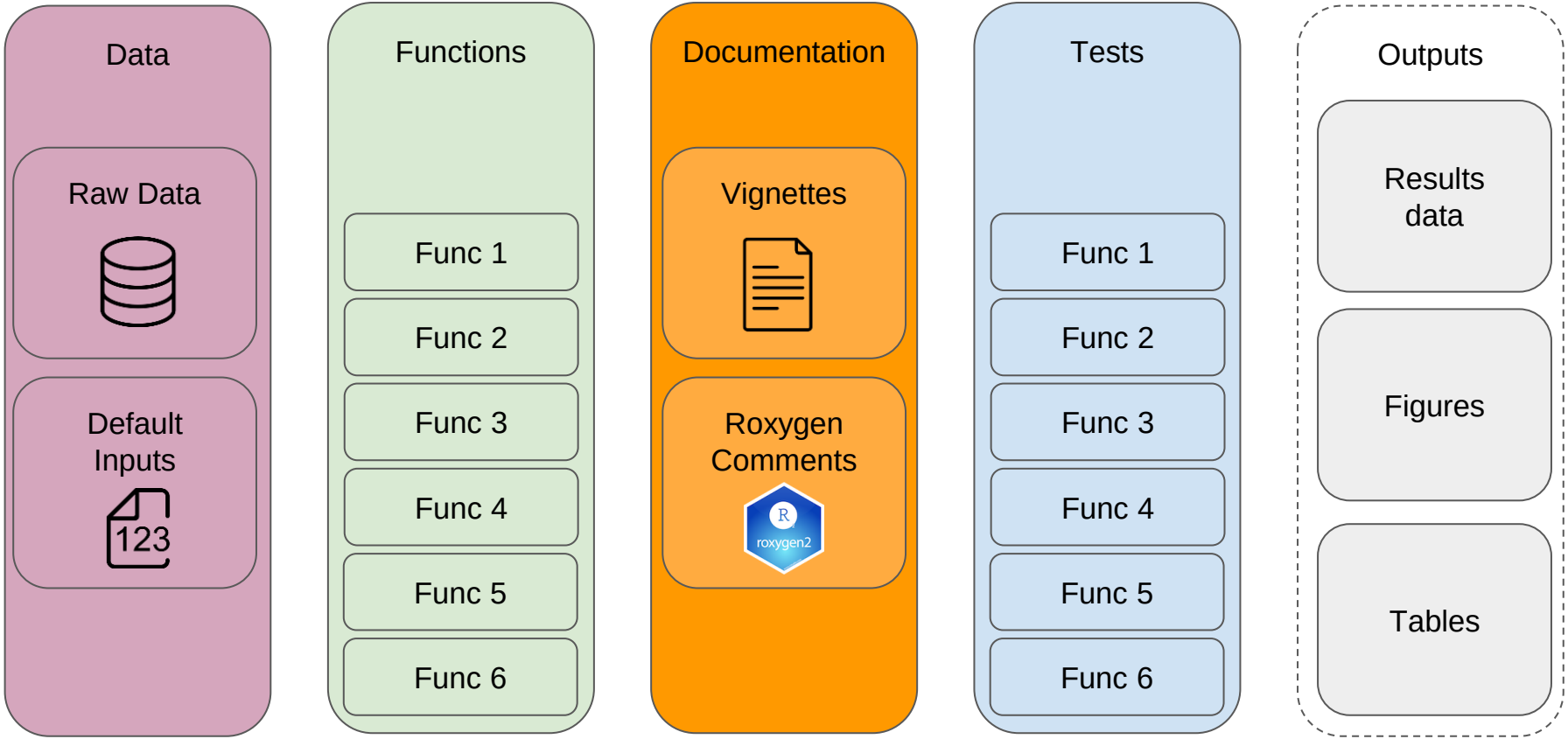

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Benefits of using a Package vs non-packaged code.

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1. Every Package will have a similar structure
    a. Improves familiarity with models.
2. Documentation by default
    a. Vignettes to show how the package works (walking the user through the code).
    b. Roxygen comments on every function (exactly what is it doing)
3. Unit testing is built-in
    a. Testing gives modeller confidence in their methods.
    b. Testing allows reviewers to ‘test the tests’ rather than from scratch.
4. Functions are more easily distributed (e.g. install_github(“your-package”))
    a. Therefore don’t have to continually re-invent wheels
    b. Standardisation (pros and cons)
    c. Validation (easier to review, more confidence)

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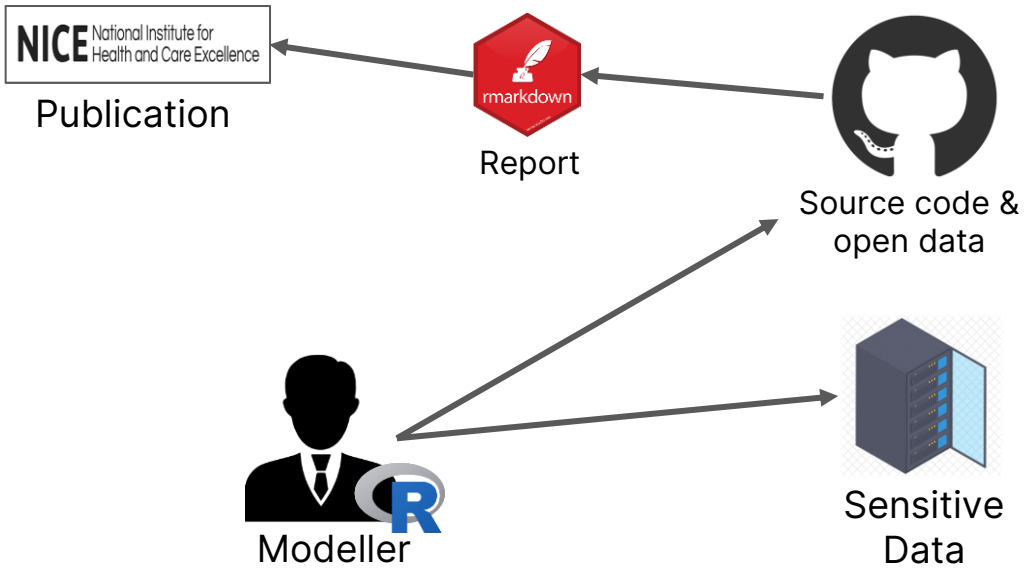
External review options



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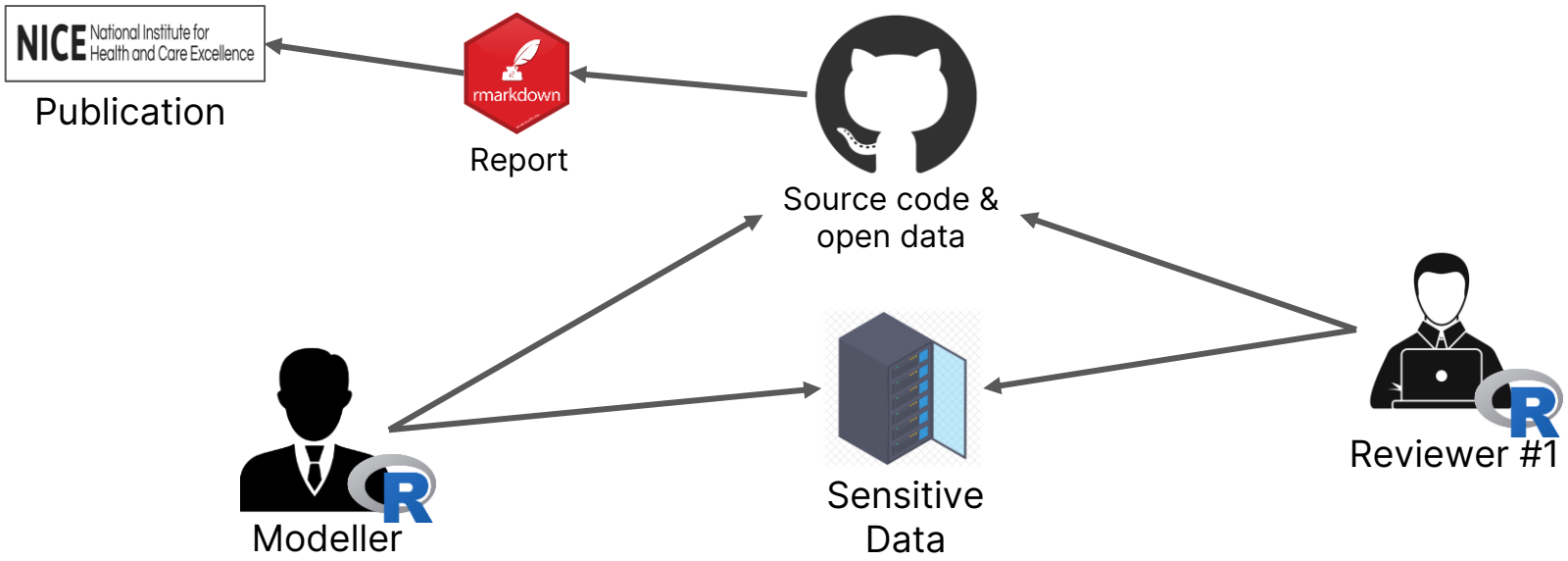

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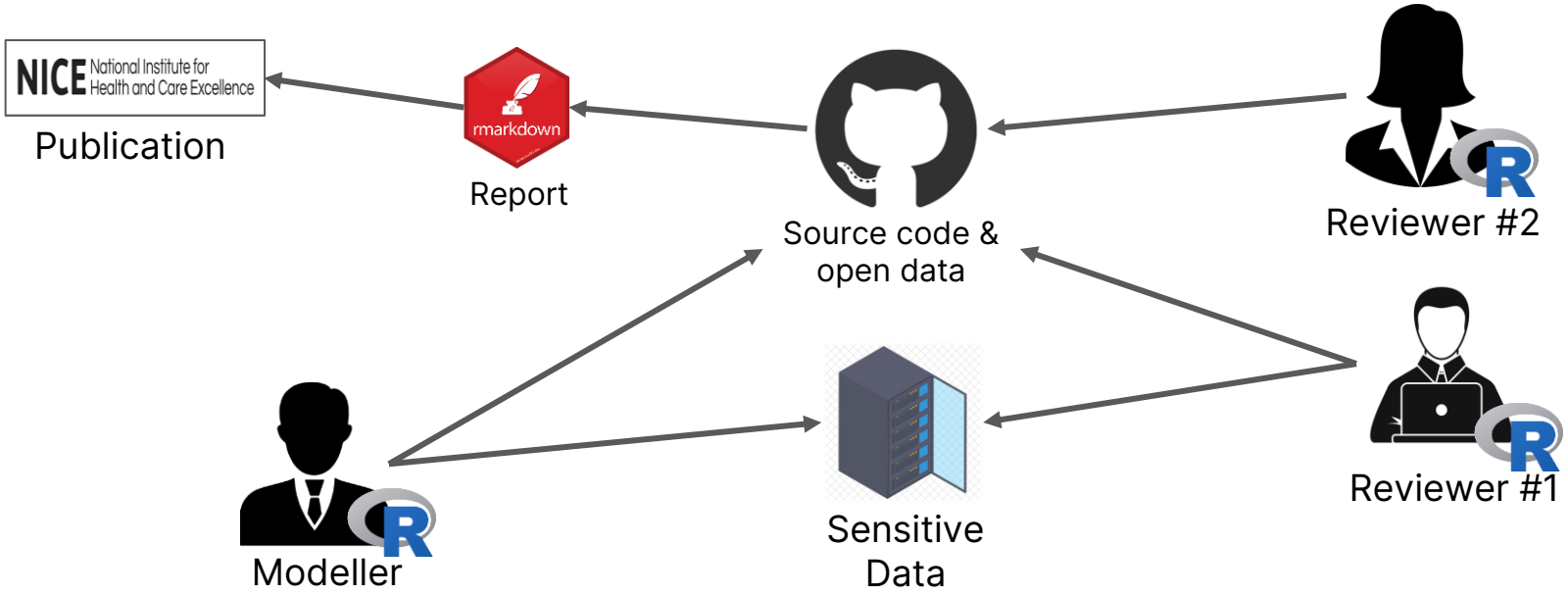

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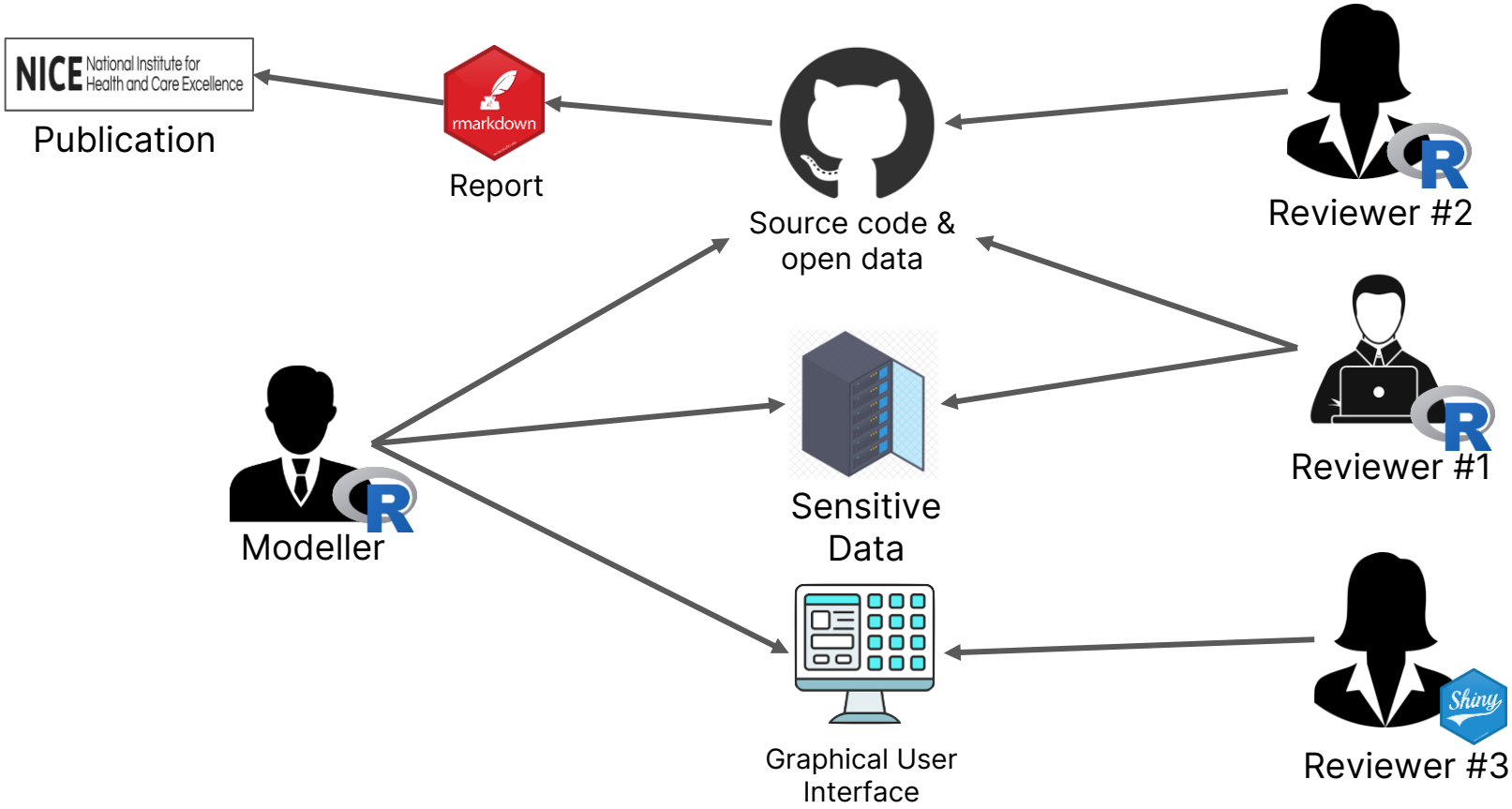

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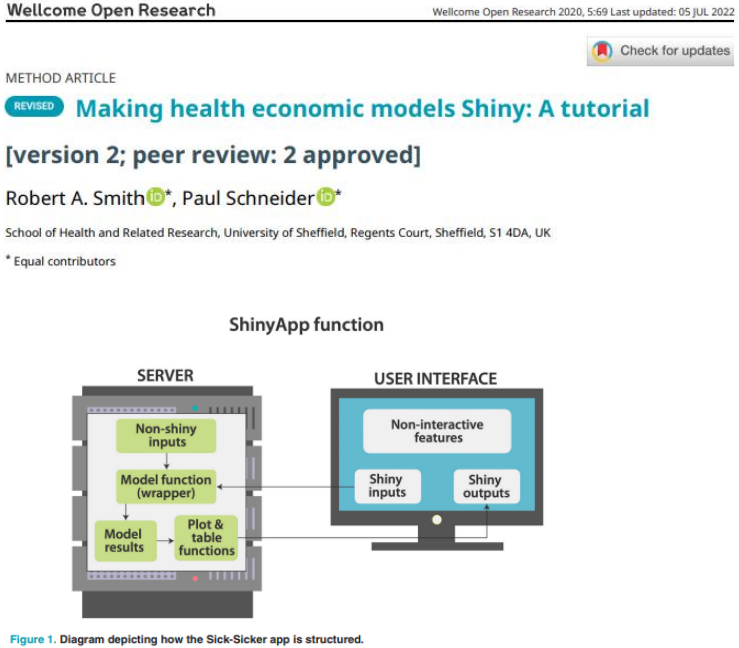
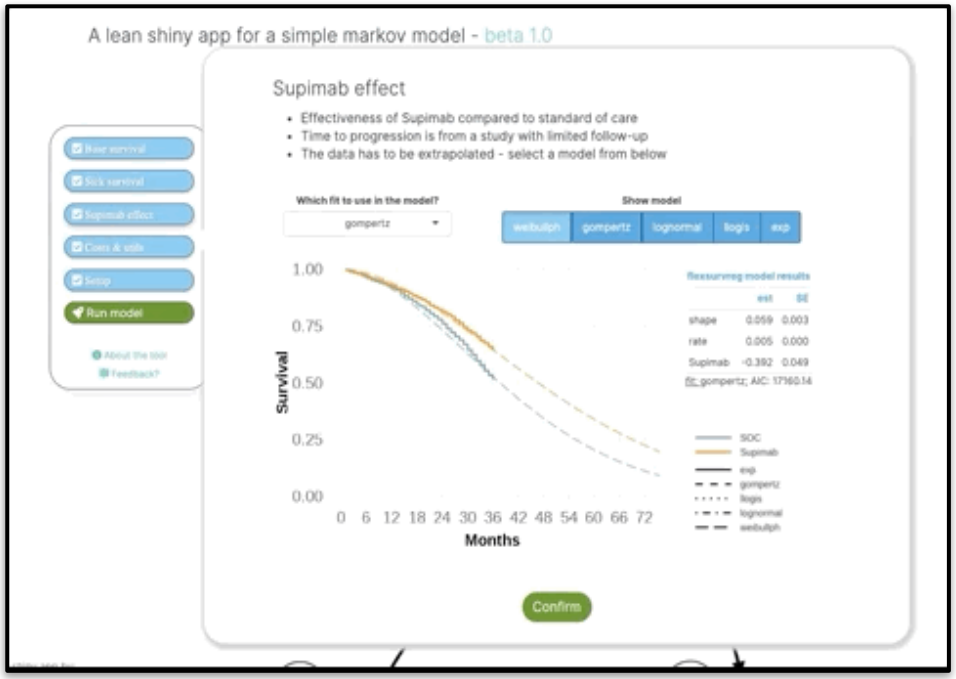
User-interfaces





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https://darkpeakanalytics.shinyapps.io/sadm-mk2/

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Long term vision

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Challenges and Opportunities

Challenges:

1. Skills gap
2. Wariness of disruption
3. Transparency (concerns around)
4. First movers ?

Opportunities

1. Increased modelling efficiency (and ease of review)
2. Increased transparency (benefits of)
3. Potential for open source peer review
4. Establishing best practices & standardisation of methods


– Thanks from Sheffield –
darkpeakanalytics.com/
contact@darkpeakanalytics.com/
github.com/dark-peak-analytics
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Further resources

Peer Reviewed Publications

Smith, R.A., and **Schneider, P.P.** (2020). Making health economic models Shiny: A tutorial. *Wellcome Open Res*, 5, 69. https://doi.org/10.12688/wellcomeopenres.15807.2

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Smith, R.A., Mohammed, W. and **Schneider, P.P.** (2023). R Packages for health economic evaluation: A tutorial. *Wellcome Open Res (In Press)*.

Open Source Code

Source code for Shiny:	https://github.com/RobertASmith/healthecon_shiny
Source code code for Living HTA:	https://github.com/RobertASmith/plumberHE
Source code for Packages:	https://github.com/dark-peak-analytics/sicksickerPack